

# Institute for Ultra-Strong Composites by Computational Design (US-COMP)

Completed Technology Project (2017 - 2022)



## Project Introduction

The Institute for Ultra-Strong Composites by Computational Design (US-COMP) will serve as a focal point for partnerships between NASA, other federal agencies, industry, and academia to: (1) enable computationally-driven development of CNT-based ultra-high strength lightweight structural materials and (2) expand the resource of highly skilled scientists, engineers and technologists in this emerging field to enhance the U.S. leadership in critical lightweight structural materials. The research objectives of US-COMP are to:

- Establish a new computationally-driven material design paradigm for rapid material development and deployment
- Develop a novel UHSL structural material for use in deep space exploration. The panel-level tests and demonstration of the novel materials will be carried out to move the developed technology to TRL-4 or higher
- Develop modeling, processing, and testing tools and methods for CNT assemblage-based UHSL materials
- Train a pool of highly skilled scientists and engineers to contribute to the materials development workforce

The team will develop the following technologies and have a major impact on the aerospace community:

- Lightweight structural materials based on 1 dimensional and 1.5 dimensional CNT building blocks with the exceptional strength, modulus, and fracture toughness properties necessary for manned Mars missions and other space explorations
- A new computationally-driven materials design paradigm to develop the UHSL material of interest and for future rapid materials design and development
- Fundamental understanding of load transfer and multiscale failure mechanisms of CNT assemblage composite materials to approach their theoretical performance
- A full set of engineering performance data from for the developed UHSL material
- A new suite of multi-scale mechanical characterization tools and protocols for CNT materials

## Anticipated Benefits

Provide NASA and aerospace community with: Ultra high strength, lightweight material systems. Innovative computationally accelerated materials development paradigm for a wide range of optimal materials design. New university/industry/federal laboratory partnerships that can lead to future technological advances. Convenient one-stop shop for cutting edge materials development expertise and numerical tools developed by the team. Pool of trained diverse emerging researchers with talents that can contribute to the materials development workforce. Global competitive edge in the development of novel materials for future aerospace applications.



Institute for Ultra-Strong Composites by Computational Design

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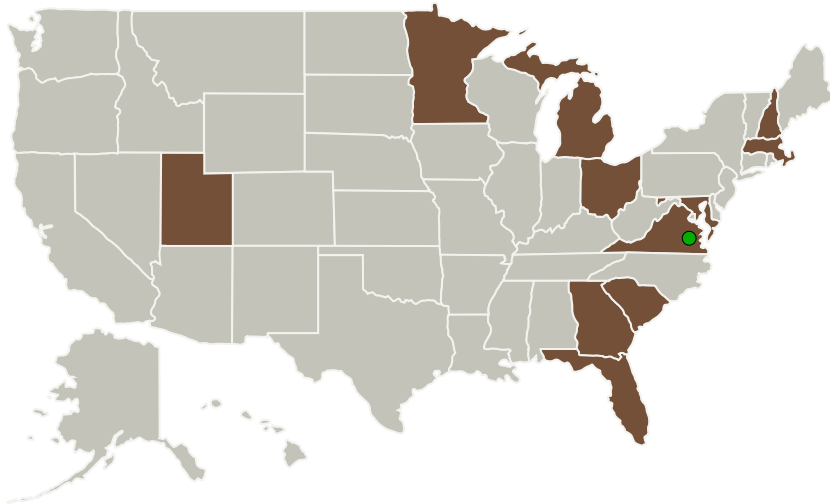
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## Primary U.S. Work Locations and Key Partners



## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Michigan Technological University (MTU)

### Responsible Program:

Space Technology Research Grants

## Project Management

### Program Director:

Claudia M Meyer

### Program Manager:

Hung D Nguyen

### Principal Investigator:

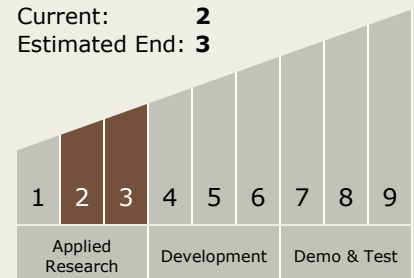
Gregory M Odegard

## Technology Maturity (TRL)

Start: 2

Current: 2

Estimated End: 3



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Organizations Performing Work	Role	Type	Location
Michigan Technological University(MTU)	Lead Organization	Academia	Houghton, Michigan
Air Force Research Laboratory(AFRL)	Supporting Organization	US Government	Notre Dame, Indiana
Florida Agricultural and Mechanical University(FAMU)	Supporting Organization	Academia Historically Black Colleges and Universities (HBCU)	Tallahassee, Florida
Georgia Institute of Technology-Main Campus(GA Tech)	Supporting Organization	Academia	Atlanta, Georgia
Johns Hopkins University	Supporting Organization	Academia	Baltimore, Maryland
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia
Massachusetts Institute of Technology(MIT)	Supporting Organization	Academia	Cambridge, Massachusetts
Nanocomp Technologies	Supporting Organization	Industry	
Solvay	Supporting Organization	Industry	Brussels, Outside the United States, Belgium
University of Florida	Supporting Organization	Academia	Gainesville, Florida

Continued on following page.

## Technology Areas

## Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

## Target Destinations

The Moon, Mars, Others Inside the Solar System

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Organizations Performing Work	Role	Type	Location
University of Minnesota-Twin Cities	Supporting Organization	Academia Asian American Native American Pacific Islander (AANAPISI)	Minneapolis, Minnesota
University of Utah	Supporting Organization	Academia	Salt Lake City, Utah
Virginia Commonwealth University	Supporting Organization	Academia	Richmond, Virginia

Primary U.S. Work Locations	
Florida	Georgia
Maryland	Massachusetts
Michigan	Minnesota
New Hampshire	Ohio
South Carolina	Utah
Virginia	

**Project Website:**<https://www.nasa.gov/strg#.VQb6T0jJzyE>